The JOHNSON NATIONAL DRILLERS JOURNAL

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GROUND WATER RESOURCES AND THEIR CONSERVATION

Well drillers all over the country are in better shape for material than they have been for several years. What they need now is jobs. Fortunately, there are plenty of wells to be built, but there are also more drillers to build them — competition will be keen and the hustlers will get the business.

The Yield of Springs and Internal Water

Any one in the business of producing or developing ground water knows the term "spring water." We frequently hear of springs which produce water of exceptionally high quality, so much so, that the water from them is said to have unusual medicinal properties of great value. It is true that there are many springs in this country, both large and small, some of which have highly mineralized waters and others highly contaminated waters.

The question that comes up with well drillers and also owners of springs is what can be done to increase the flow of springs or restore their flow once it has stopped. To get at this problem, one must have a clear understanding of springs, their formation, their water supply, and their limitations as dependable sources of water supply.

Springs are essentially geologic freaks. Their origin is oftentimes mysterious and not easily accounted for, and down through the years springs have occupied such a place in history and the minds of men that they often have a fictitious value. Basically, springs are entirely a product or rather due to certain geological conditions. Actually, a spring is a place where water flows from a rock or the soil without the help of man. It is a discharge of ground water which may occur either above or below the main water table, due to local geological conditions. Naturally, all water discharged by springs is water that originally fell at the earth's surface somewhere.

Springs can be divided into several classes, depending on their characteristics, such as, the character of the openings from which water is flowing, or the rock structure, and the force causing the water to flow at the surface, the chemical nature of the water flowing, its temperature, quantity, and uniformity of discharge, the permanence of the flow, etc. All of these things enter into the classification of springs.

Considering the openings through which springs flow, they may be seepage springs, or water flowing from many small openings, or they may be fracture springs where the water flows from joints, fractures or fissures in the formation. Again the flow may be from more or less rounded openings such as the solution channels found in limestone formations or the natural passages in a basaltic lava. These are known as tubular springs.

When considered from the standpoint of the force causing a spring to flow, there are gravity springs due to an outcrop of the water table. By contrast, there are artesian springs which flow under pressure through some fissure or opening having access to an artesian water bed. Gravity springs are divided into depression springs where water flows to the surface simply because the surface extends downward to the water table, or the spring may be a contact spring which flows because the water cannot percolate downward on account of an impermeable formation.

Water issuing from the surface under pressure is generally assumed to be from deep rock formations, possibly internal water if it is heated. Such springs have a fairly steady flow without seasonal fluctuations. They are often found along faults or other openings which will allow the escape of water from great depths. Springs are often designated as limestone springs, sandstone springs, quartzite springs, etc. Sometimes we hear of strong springs or weak

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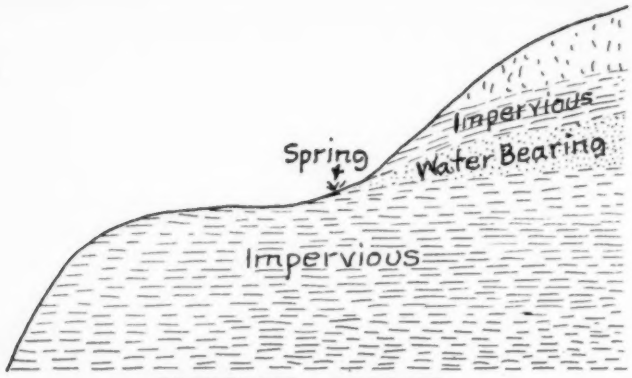

CONTACT SPRING
(Artesian Flow)

(Continued from Page 1)

springs all depending on our viewpoint. For this reason, springs in the United States are classified as follows with respect to their discharge.

Magnitude	Discharge G.P.M.
First	45,000 or more
Second	4,500 to 45,000
Third	450 to 4,500
Fourth	100 to 450
Fifth	10 to 100
Sixth	1 to 10
Seventh	1 pint to 1
Eighth	Less than 1 pint

In the United States there are about ten springs of the first classification and perhaps fifty in the second classification. Not all springs are constant in flow, therefore a constant spring is defined as one that does not vary in flow more than 25%. A subvariable spring is one that varies in flow from 25% but not more than 100%, while a variable spring is one that varies in flow 100% or more.

There is practically no limit to the classification of springs, as they may be intermittent springs, flowing part of the time, or perennial springs which flow continuously. A geyser is an intermittent spring in which the discharge force comes from heated steam. A thermal spring is one whose water has a temperature above the mean annual atmosphere temperature in the locality. A hot spring is one whose water has a higher temperature than the human body, about 98 degrees Fahrenheit. A warm spring is one with a temperature less than that of the human body. A cold spring is one where water cannot be classed as thermal or hot.

In some places, springs occur as discharges from deep pools. In other places, springs may be found as mounds created by the deposition of the water from them. Generally these deposits are terraced and the water flowing over the surfaces constantly add to the height of the mound. In many of the valleys in the mountains of the West where water is derived from melting snow, springs in the valley reach their maximum flow soon after the high water has passed. Springs that obtain their supply from highly permeably overlying formations usually have a steady flow, as such material will absorb and also discharge large quantities of water with very little change in the water table. The streams flowing from the sand hills in Nebraska which have a good flow even in dry seasons are a good illustration of this type of spring. The behavior of springs is sometimes hard to explain, as there are places where springs that have been dry will start flowing apparently for no reason. In California and other areas having a distinct wet and dry season, this is quite common. It is explained by the fact that at certain times in the fall, evaporation and transpiration decrease suddenly. In some places, springs resume their flow due to lag in the movement of water from a prior wet season.

Permanent changes in springs are due to many natural and artificial agents and they may occur slowly or very suddenly. It is difficult to determine the exact cause in many cases as new springs may be created when old ones disappear. Movements in or on the earth's crust account for many changes in spring flow. In the same way, man himself can be responsible as the flow of many springs may be and is affected by the construction of

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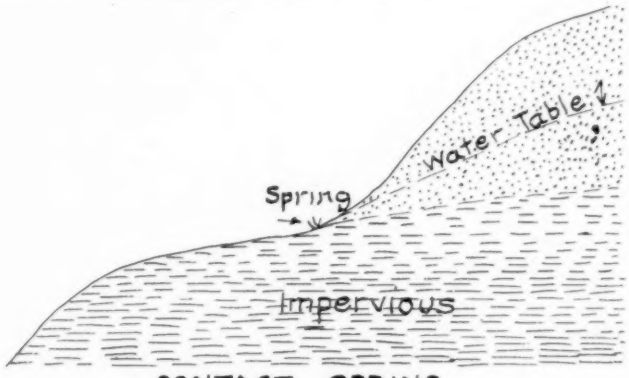
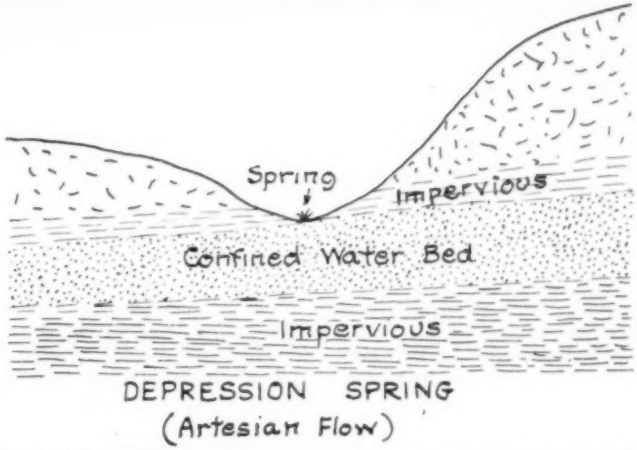


CONTACT SPRING
(Gravity Flow)

(Continued from Page 2)

wells, dams, tunnels, mines, and drainage works. Even the removal of timber or rotation of surface crops may affect the flow of a spring.

We often are asked as to the effect of earthquakes on wells. Cases have been reported of wells either increasing in capacity or going dry after an earthquake. It is hard to say just how much change in a well or spring is due to an earthquake. We know that the water levels will rise and fall and that springs are affected. After such occurrences, the water may be roily or changed in temperature or gas may be given off. Rapid changes in the water table level or static level are often due to earthquakes at considerable distance.

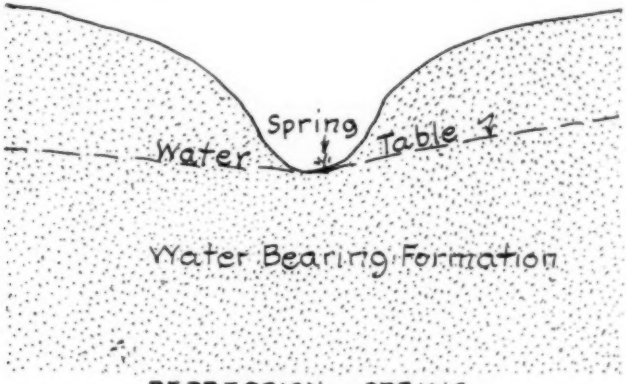


DEPRESSION SPRING
(Artesian Flow)

The flow of springs can be readily measured by any convenient accurate means, though if several springs are involved, it may not be so easy to determine the flow of each separate spring. Springs such as the Giant Springs in Montana have been measured and found to be about 270,000 g.p.m. This was determined by measuring the flow of the Missouri River above and below the springs.

The problem of increasing the flow of springs first involves careful study of the spring itself. Actually, there is no way of increasing the flow of a spring, except by increasing the surface openings where the ground water conditions are such that additional water will flow if allowed to. In most cases, it is impossible to increase the flow of a spring, especially where the flow is under pressure, as additional outlets simply reduce the pressure and consequently the flow. It is much better to work towards confining or collecting the flow of a spring in such a way that its steady yield can be used. In other words, it usually is more practical to conserve the safe yield of a spring than it is to try to increase it.

The subject of springs brings up another phenomena in connection with them and that is changes in barometric pressure. There is no question that such changes in pressure affect the flow of springs but no one knows how much. The same changes in pressure affect wells causing them to "blow" or to "breathe." Many well owners and well drillers have reported such wells, as they are found in many parts of the United States. Dr. G. E. Condra, Director of Conservation and Survey Division, University of Nebraska, in Water Supply Paper 216, published over forty years ago, described the blowing wells found in most counties of southern Nebraska. The writer, being a native of Nebraska, has also observed these wells. They are present in the area covered with loess which is a fine, even-grained, porous texture formation forming massive bluffs. It does not weather easily and is found in many places in Nebraska. Well drillers mistakenly refer to it as yellow clay. Under the loess there are beds of sand and gravel which in many places are only partially filled with water. During times of high barometric pressure, air moves down into the wells and out into the dry sand and gravel above the water table. When the barometer is steady, there is no movement, either in or out, but when the barometer is low, the air will move out of the dry sand and gravel causing an upward movement in the well casing. The well is then a "blowing well," as it is a connection between the air in the dry sand and the surface where air pressure is constantly changing. The loess formation above the dry sand and gravel being so much less pervious to the movement of air,



DEPRESSION SPRING
(Gravity Flow)

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Ground Water Resources and Their Conservation

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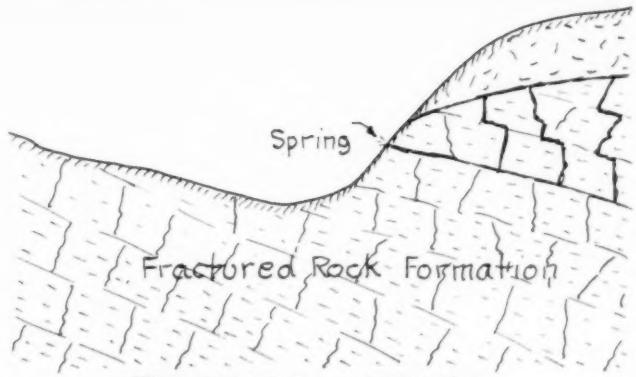
acts as a blanket while the well being open, affords a ready outlet for either upward or downward movement of air. The rate of movement varies with the differences in pressure between the air at the surface and in the dry gravel bed, also with the porosity of the gravel and the loess. The depth and diameter of the well also have a bearing on the strength of the blowing or breathing. The phenomena is more noticeable and stronger in small diameter wells. Changes in the water table level also increase or diminish the thickness of the dry sand and gravel. Thus a rise in the water table displaces air. In cold climates, this movement of air may cause freezing of pipes to as much as 100 feet below the surface.

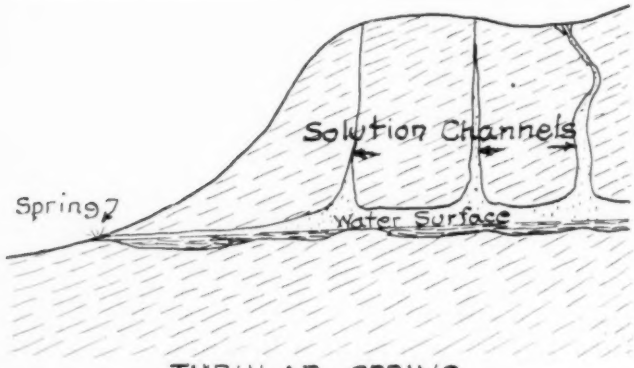
Whenever air flows into or out of the soil, it carries some water in the form of vapor. Whenever unsaturated air enters the pores of a formation that contains liquid water, it absorbs water until saturated. Thus a movement of air in a formation may deposit the water it contains. If the air temperature is higher than that of the formation and becomes cooled, then there is condensation and a deposition of liquid water. Many strange things happen in and around wells and springs. Not all of the happenings can be readily explained. However, it is of interest to know of these things as they frequently furnish the only reasonable answer to the problem.



FRACTURE SPRING
(Flow from joints or fractures)

Still another phase of ground water may be of interest. That is the question of water depth. We commonly speak of the zone of saturation, meaning the zone wherein all openings, pores, interstices, fissures, and cracks are filled with water. What of the zone below this? Is it dry or does it contain water in some form. We know that formation pressures and temperatures increase with depth and that there are no openings of any kind.

Much study has been devoted to this subject and we still do not know much about it. Dr. O. E. Meinzer in Water Supply Paper 494 shows the divisions of underground water and a zone of rock flowage containing internal water. He definies internal water as the water in the interior of the earth, where the pressure of overlying rocks is so great that interstices cannot exist. It is the consensus of opinion that under such conditions the mineral constituents form a solution called "rock magna" which contains one or both of the elements of which water is formed. In other words, the thinking is that while there may be a limit to the depth at which liquid water is found, there may be no limit to the point where it occurs in another form.



TUBULAR SPRING
(Flow from solution channels)

From this reasoning, we can assume that part of the water thrown up by volcanoes is of internal origin in the same way that lava is of internal origin. Many igneous rocks give evidence of the production of water through structural features recording the events of the past. Volcanoes and hot springs are evidence of the same process as it is going on now. Technically, water found in the interior of the earth is called juvenile water. There is much difference of opinion as to the source and origin of juvenile water due to our inability to locate the zone of rock flowage accurately. If this zone marks the lower limit of openings in the rock, then it also marks the

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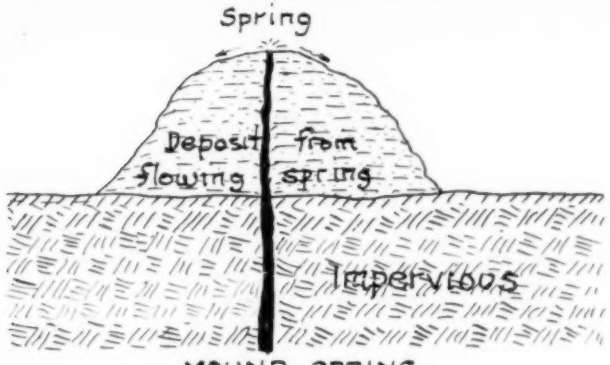

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lowest possible point where ground water can be found.

All well drillers know that there is no relation between porosity or open spaces and the depth at which they are found. Very dense heavy granites are often found at the surface while porous sandstones are found many hundreds of feet below the surface. In general, porosity decreases with depth, with the larger openings disappearing as great depths are reached. The water in most crystalline rocks is found within 300 to 500 feet below the surface. Beyond these depths there is no need of drilling. On the other hand, porous water-bearing rocks have been found more than 6,000 feet below the surface. It is widely believed by geologists and well drillers that there are porous beds at great depths which contain no water. Dr. O. E. Meinzer did not agree with this as he said in Water Supply Paper 489, "the extensive occurrence of nonsaturated strata below the zone of saturation is difficult to understand. It is hard to see how water present at their deposition could have been removed, or how, if once dry, they could be kept from becoming saturated unless they were entirely incased by impervious materials."

Only a small proportion of the flow of our larger springs is conserved for beneficial use, while many smaller springs are developed to their full capacity. The problem of developing springs and of maintaining and conserving their flow is very important, especially if the water has medicinal properties. Many spas and resorts are built up on the flow from springs. Just recently a famous spa in Mexico claims to have radium baths, as a spring water supply is supposed to be radioactive. Efforts have been made to increase the flow of the spring without results. After all is said and done, the development of springs beyond their natural capacity is a hazardous job and should always be borne in mind that the flow of springs is dependent on several factors and that the failure of any one may mean the failure of the spring and the installations built up around it.

The nurse entered the room of the absent-minded professor and said softly, "It's a boy, Sir."

Looking up from his desk, the professor replied, "Well, what does he want?"

"You say this woman shot her husband with this pistol, and at close range?" asked the coroner of the eye witness to a colored tragedy.

"Yassuh," replied the witness.

"Are these powder marks on his body?"

"Yassuh, das why she shot him."

A young housewife went to buy a drinking trough for her cat. The clerk asked her if she would like one with the inscription "For the Cat."

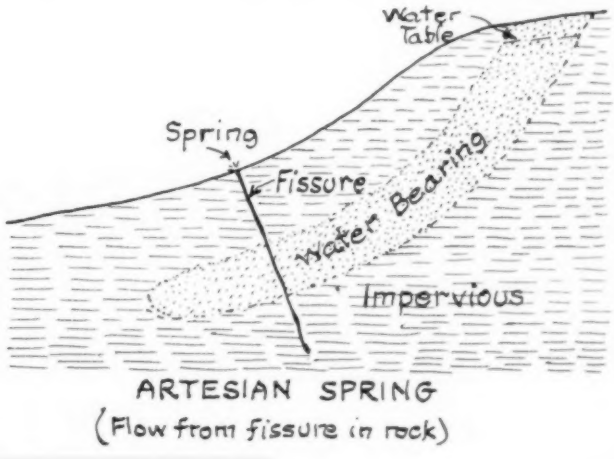
"It really doesn't matter," she replied. "My husband never drinks water and the cat can't read."

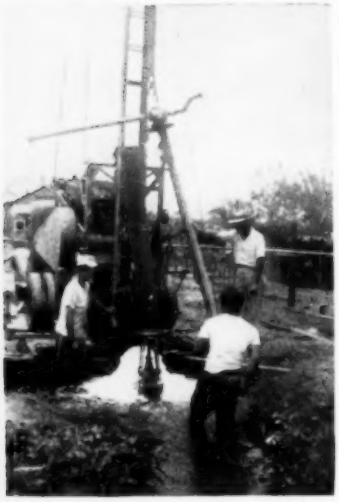
"He seems to have a very good opinion of himself."

"Yes. On his last birthday he sent his parents a telegram of congratulation."

Wife (ordering a new hat)—"What kind of bird will I have on it?"

Husband—"One with a small bill."





Mr. Sam Wong of the Division of Hydrology, Territory of Hawaii, sent us this picture of Nat Whiton and his two helpers working on an artesian well at Honolulu, Oahu, T. H. The well has just been recased. It is 395 feet deep and flows 1,000,000 gallons per day.

Middle age is that period in a man's life when he would rather not have a good time than have to get over it.

2,500 TEST HOLES

Next time you see a drilling rig (like the one pictured below) along a Nebraska highway or byway, don't jump to the conclusion that somebody is probing the earth for oil or uranium.

Chances are it will be a portable outfit manned by a crew from the University of Nebraska's Conservation and Survey Division, digging another test well—and looking, not for oil, but for more information about the state's great hidden natural resource called ground water.

Carried on for 40 years under the direction of Dr. George E. Condra, chief of the division, the ground water survey has produced a wealth of information about what lies beneath the topsoil. And this information, in turn, has helped thousands of farmers wrest millions of dollars of material wealth from that topsoil. It has aided industries locate their plants, assisted cities and towns locate water supplies, and it even helped the war.

Nearly 2,500 test wells have been drilled, most of them since 1930, when the Groundwater Division of the U. S. Geological Survey became a partner in the project on a dollar matching basis. The wells dot the state in a pattern which reveals the most vital facts about the water supply beneath the state's surface.

To the geologists, drilling a test well is much more than just digging a hole in the ground. It is the first phase of a complicated, precise, scientific procedure which determines the "where," "how deep," "how much" and even the "how come" of Nebraska's ground water.

From the time the spudding-in bit first sinks into the topsoil until the drilling bit strikes shale or limestone, an accurate log of the operation is carefully kept.

The log classifies all material through which the shaft sinks, describes drilling action, and records (to the tenth of a minute) the time required to drill each five feet. Samples of material found at each level are taken. An average 500-foot well will yield about 125 samples.

A few days after drilling, water level is measured. The well (four inches in diameter) is then plugged with clay—unless it is to be kept as a permanent observation well. Some 500 observation wells are maintained, to give the geologists periodic peeps at the current status of Nebraska's vast subterranean reservoir. Such wells are cased after drilling; otherwise the holes are not cased.

But the well drilling is only the first step. At the university's geology laboratories, samples are unsacked for further classification and study under a microscope.

Samples, drilling logs, laboratory records and observation well reports provide the source material from which the geologists put together an underground picture of the entire state, revealing its history for past ages—and showing where you're most likely to strike a good water supply if you want to dig a well.

A lot of people do write to the Conservation and Survey Division to find out exactly that.

Facts gathered by the university's geologists have helped locate hundreds of the wells that now irrigate more than 350,000 acres of Nebraska cropland. Cities and towns have found dependable water supplies through the division's help. The division's data has

(Continued on Page 7)

Test well drilling rig used by the University of Nebraska Conservation and Survey Division, co-operating since 1930 with the Ground Water Division of the U. S. Geological Survey.

Many of the wells drilled in Michigan are for suburban homes and developments. In this picture, one of Jay Slingerland's nephews is operating a hollow rod rig at a new home west of Owasso.

(Continued from Page 6)

helped determine good industrial plant locations. During the war, locations of army and navy installations in the state were determined—in part, at least— by the location of dependable water supplies, as revealed by the university's underground probings.

Dr. Condra's scientists estimate the state's "underground reservoir" contains about 970 million acre feet of water. That's ten times the amount that falls on the surface in the form of rain and snow in a year. (One acre foot is over 325,850 gallons.)

All that water isn't sloshing around down there, nor does it flow in underground tunnels, as some people mistakenly believe. It seeps slowly through the sands and gravels. And it doesn't always move in the same direction as surface streams and rivers, although its movement generally is from northwest to southeast.

Ground water is a changing resource, requiring continuing research to answer new and complex problems.

Part of that continuing research you see when you see a University of Nebraska crew drilling another hole in the ground.—Farm Credit Leader, Summer, 1949.

ADVERTISEMENTS

We will insert advertisements for drilling equipment wanted or for sale, help or work wanted, etc., for our readers, free of charge. Advertisements must be brief, and we cannot assume responsibility for them, but will be glad to put parties in touch with each other by this means and suggest that they investigate any offers or inquiries carefully for themselves.

FOR SALE: Sanderson-Cyclone wood frame truck mounted drilling machine without tools, very cheap. Write, Abe Fasnacht, 108 Hazlett Ave. N. W., Canton, Ohio.

WANTED: Would like to trade my farm land for Failing Rotary 750 Signo drill with equipment, all the tools, and drill pipe up to 700 feet. Write: Steve Rutar, Bruce, Alberta, Canada.

WANTED TO BUY: Band wheel rig that will handle from 4-inch to 8-inch tools. Write: B. W. c/o Edward E. Johnson, Inc., 2304 Long Avenue, St. Paul 4, Minnesota, furnishing all details regarding tools, mounting, etc.

FOR SALE: Failing 1,500-ft. capacity drill, complete, bits, drill rod, tools, etc. Also Sullivan rotary 1,000-ft. capacity, complete, both now on water wells in vicinity of Bell Fourche, South Dakota. Write: Fred E. Butler, 1013 So. Cedar, Casper, Wyoming.

FOR SALE: Model 50, Keystone Drilling Machine, 14 months old, first-class shape, working every day. Machine mounted on 10-wheel Army GMC truck, '48 motor, rebuilt; with or without tools. Best offer. Reason for selling, bad health. Write: F. B. Rogers, Jessup, Maryland, phone Waterloo 483W1.

FOR SALE: 3½ Keystone truck, mounted, 4 and 6-in. tools. Just completely overhauled. Write: L. B. Leverich, Route 2, Edgerton, Ohio.

FOR SALE: All steel Howell 160 Model drill, A-1 condition, rebuilt drill and motor, 34-foot derrick; Ideco rubber shock in top of mask; 400 feet ⅝-in. cable, 500 feet ⅜-in. cable, 1 set of 6-in. tools on 1933 3-ton International truck, fair condition. Price $2,200.00. Also two No. 3 Wood Keystone drills, 1 on 1933 C-40 International truck; cable line, spring shock in derrick, fair condition; 6-in. tools, clutch gear hoist on bull reel, price $900.00; One Keystone drill on 1929 Indiana truck, fair condition, friction hoist, rope, with 6-in. tools, price $500.00. Write: Harry Green, Damascus, Maryland.

BUSINESS FOR SALE: In one location for over twenty-five years. Well and pump business. All equipment in first-class shape; 3" to 8" wells; plenty of tools, etc. to make up a complete well and pump service. Shop is 32x65, is built of cement blocks; seven room house, modern. Will take $5,000.00 for the down payment. No interest on the balance. Write: R. C. Hessler, 452 W. Shadbolt Street, Lake Orion, Michigan.

WANTED: Experienced well driller in midwestern state. Write: Box C, c/o Edward E. Johnson, Inc., 2304 Long Ave., St. Paul 4, Minnesota.

WANTED: Complete Rotary drilling sets for drilling water wells 4", 6", 8", 10", 12" and 14" diameters, depths up to 500 ft. Quote full descriptions of plants offered together with working capacity in normal strata with each size of bit, etc. Contact M/s Shree Ram Dass & Bros, 7/81 Tilaknagar, Kanpur (U.P.) India.

FOR SALE: One 33-W Bucyrus Erie, one combination rotary and jetting machine for 2" to 4" well mounted on a two-wheel trailer. Write: Nick Rapp Box 311, Summerville, South Carolina.

DRILLING MACHINE AND TOOLS for sale or trade for car or pickup. Write: Everett Ramey, R.R. No. 3, Weatherford, Okla.

HELP WANTED: Reliable cable tool driller to operate new 42 Cyclone; mostly 5⅝" diameter; farm and suburban wells in rock or gravel; real opportunity. Write: Curtis C. Conway, 213 N. Robert Blvd., Dayton 2, Ohio.

(Continued on Page 9)

Nebraska is noted for its ample supply of ground water and easy drilling conditions. Here is a reverse rotary drilling rig operated by the York Well and Irrigation Company in central Nebraska.

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TOM'S COLUMN

Dear Fellows:

This has been one of them winters when every time you think you had it licked an' down fer the count it got up again an' banged you fer a loop. Up around our section of the country we been havin' a harder time shakin' off the fag end of an aggravatin' stretch of winter than Swig McGrew used to have gettin' rid of the heeby jeebies after a long bout with the bottle. When Swig was rassling with these torments he was kind of hard to live with an' most of us kept our distance. Once in a while somebody would take a chance on givin' him some advice on the evils of the demon rum—but Swig would just let go of a stream of tobacco juice an' fix us with a cold eye. He growled to me once that every man in his life is entitled to a certain quantity of alcohol an' he sez fer a man of my capacity I aint had my share yet, so shut up.

Well anyway there's hopeful signs of balmier weather showin' up an' there's some pretty good signs of increased drillin' activities fer the boys who are operatin' on a business like basis.

The boy and me just finished up some work that made us feel pretty good because we was able to show some results that the customer could understand. This well wasn't workin' right an' when we looked into the situation it was fairly clear that whoever drilled that well didn't concern himself much with water development. He just drove the pipe down to the water bearin' formation, stuck in a screen an' called it a day. Of course the customer didn't know any different — most customers don't. They gotta rely on the driller knowin' his business. Well we went at it with compressed air and did a good job of surging until we built a filter pack around the outside of that screen—an' at the same time we kept that customer informed of what we was doin'. We think we have it producin' now at about its maximum, and y'know that customer never did know before that the well had that kind of capacity. From now on we think he understands what we mean when we talk about how important it is to develop the well after it is drilled. Anyway, we have that good feelin' you always get when you can honestly figger you've satisfied your customer, an' in the long run saved him some real money.

The boy has been harpin' on this business of good will ever since he got into the business. He claims that too many of us drillers was satisfied to make wages out of what he calls punchin' holes on the theory that we was real well drillers. If we want to get people to have a higher respect fer well drillin' as a profession we gotta show 'em that developin' a water supply calls fer more intelligence than just punchin' holes in the ground. He met up with an easterner who's made a success of the well dillin' business who had sat in with about 25 of the most successful drillers in the country. These men came from all parts of the United States an' they had a meetin' lately fer to discuss all the phases of this business because of the growin' impor-

(Continued on Page 9)

Colorado
Lloyd Oliver, President ..... Greeley
W. E. Code, Secretary ..... Fort Collins

Empire State
Fred H. Merrill, Jr., President ..... Liverpool
Robert Klindt, Secy.-Treas. ..... Morris

Florida
A. C. Gray, President ..... Jacksonville
R. M. Vickers, Secretary ..... Miami

Idaho
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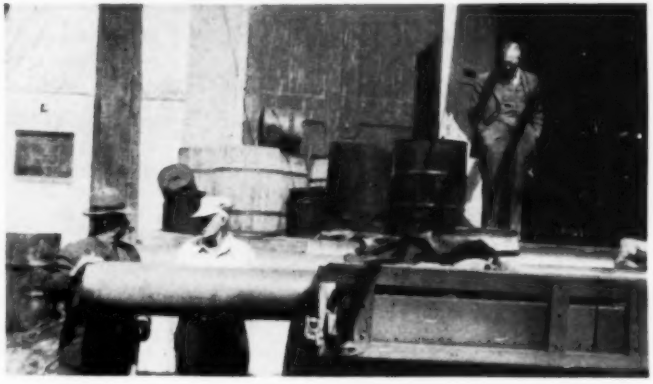
(Continued from Page 8)

tance of water supply. Now none of these men are sufferin' because they don't know how to drill wells an' some of them are familiar with the scientific an' engineerin' side of water development. What they're concerned about mostly is how to get the public an' the people they do business with to understand the real importance of proper well drillin'. They must have had quite a session from what this man told the boy, an' among the important things they come to agree on was to find good sound methods fer promotion, sellin', an' contractin' fer new work that will produce results an' build up the business. Before they can do that properly, they figger they should have the equipment to operate efficiently, a sound business policy, and a book keepin' system that keeps a man informed regardin' the condition of his business all the time. They know that if any business is goin' to succeed it's gotta keep within' its cost of doin' work, finish its contracts to the satisfaction of the buyer, an' make a decent profit. From what I gather, they are now lookin' into the various kinds of advertisin' an' sellin' ideas that fit the needs of Drillers accordin' to the size of jobs their capital will allow them to take, an' the territory they're in shape to cover. When you boil it all down its just a matter of recognizin' that we can't keep on goin' along in the old slip shod way an' stay in the game. If you read the papers an' the magazines now days you can't help but know that most of the states as well as the national gover'ment is hot an' bothered about water levels. They're payin' more and more attention to what used to be taken fer granted because everybody always figgered that water was always there if you had a well or a water tap. Nobody bothered much to wonder where it all come from nor what it takes to get at it. The smart fellows in well drillin' have come to learn that they're in the most important business there is—but if the well drillin' industry is gonna have much to say about the way things are to be done in the future, they better get the lead out an' do something. As the big shots say, we're at the cross roads in the drillin' game. If we can make business men an' the guys in the gover'ment bureau respect what we know about water development we can help steer a very important industry. If we don't, we'll keep on punchin' holes fer day wages with some state or bureau official callin' the signals. As the boy sez—there's plenty of good infermation on all these matters if we've got the gumption to get it an' then make use of it. That's another reason why I always was in favor of good driller organizations.

I guess this all sounds like I'm preachin' again, so I'll call it a day. We're paintin' up the rig an' lettin' the world know we're out fer business. I'll be glad to get your suggestions anytime.

Yours truly,

TOM.



During the course of a year many well drillers drive to our plant to visit and pick up screens for some hurry-up job. One of these visitors last year was Mr. Ole Riegler of Riegler Welling Drilling, Muskegon, Michigan. Mr. Riegler is shown on the left in the picture. Guess who the other two are.

BOOM HITS POWER WIRE. TWO KILLED

Two Wood County, Wisconsin, well drillers were electrocuted recently while hoisting a crane on a farm near Stevens Point, Wisconsin.

Norman Brandl, 22, and John Seefeldt, 17, both of Milladore, were preparing to enlarge a well near Junction City when the boom of their crane touched a high tension wire, killing them.

(Ads Contd.)

FOR SALE: Jerkline well drilling rig, all steel, for sale; U belt drive, water cooled cathead, model B Ford motor, mounted on 1935 International truck. For sale cheap. Write: William Mantyla, Stillwater, Minn.

WANTED: Used drill tools for wells from 6 to 30 inch; such as bits, stems, sockets, bailers, etc. Interested in one piece or carload, if price is right. Send full particulars as to pin size, weight, price, etc. Write: Libby & Freeman, P. O. Box 2927, Orlando, Florida.

FOR SALE: No. 71 Speed Star drilled three wells; 40 feet mast casing reel; cat heads; ball bearing sand reel; mounted on K-7 International truck; complete set tools, 10-8-6-5; light plant; some 6⅝" No. 8 casing; new 2-ton Ford truck with winch and oil field bed. Write or phone: Paul Pierson, Longton, Kans.

FOR SALE: One Bucyrus-Erie 21-W well drill mounted on D-35 International Truck, 1937 Model; drilling tools for three and four-inch wells; derrick is 31½ feet with rubber shock; machine and truck in first-class condition; good rubber on truck; 500 feet of practically new ⅝" drill cable; sand line is less in length but good condition; drilling tools consist of 2½" x 12' stem; 1 set jars, 1 stiff neck socket; two 4" bits and two 3" bits; 2 cast steel tool wrenches; 1 tool tightener, 1 drive clamp; 2 dart valve bailers. Write: W. G. Law, Troy, Alabama.

FOR SALE: Loomis No. 2 clipper machine with 6-cylinder engine on engine mounted on hard rubber; in good shape; Bucyrus-Erie crown sheve and shock absorber; tool guide and belt; about 300 feet ⅜" cable and 300 feet ⅝" cable; tools, bar, jars, swivel socket, bits, tool wrenches, and chain tighteners; drive blocks; in good condition. Write: Lawrence Martin, 407 North Fifth Street, Oregon, Illinois, Phone 127-K.

FOR SALE: Howell No. 60 well drill. Write: The Alton Cement Works, Alton, Iowa.

(Continued on Page 11)

SURFACE and GROUND WATER CONDITIONS

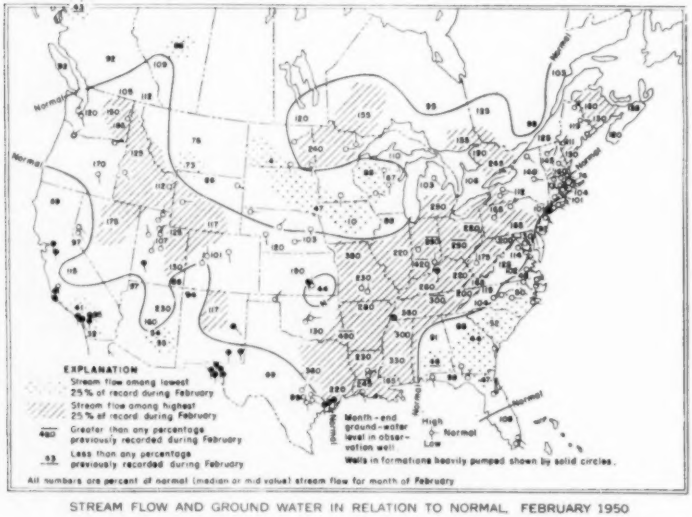
In January the reservoirs in the New York City system have benefited from above normal runoff that was quite general throughout the Northeast. Ground water levels in February continued the rise in New York and Connecticut that started in December, 1949. The outlook for normal spring runoff in the Northeast has improved greatly over January.

Stream flow was below normal along the coast from Massachusetts to Alabama in January, with deficient runoff in several small areas. High water and floods prevailed from the Great Lakes area to the Gulf of Mexico. New maximum flood discharges were recorded in Indiana, Illinois, Mississippi, and Alabama. Most of the large rivers, including Ohio and Mississippi Rivers, were high but did not approach maximum stages. In the West, stream flow and snow cover were reported near normal or above, except in Canada, southern California, and Arizona where stream flow was deficient.

In February, floods and high water prevailed generally from the Great Lakes region to the Gulf of Mexico. Record-breaking floods occurred in small areas in Ohio, Indiana, Missouri, and Louisiana. Runoff was deficient from Wisconsin and Iowa to Montana. Throughout the West, stream flow was generally well above normal except in parts of Canada and southwestern United States.

Ground water levels in New Mexico are generally more favorable than a year ago, but artesian heads continued to decline in Nevada. In upstate New York, ground water levels rose during February, in response to precipitation, except in the Adirondack Mountain area where the precipitation is stored as snow. On Long Island the recoveries were largest along the south shore, where the water table is comparatively near the surface. In Kings County, water levels have continued to rise since December, 1949.

In mid-February, 44 shallow wells in the northcentral part of the southern peninsula of Michigan showed a continuation of the recovery from the low stage of November, 1949. In Indiana water levels in observation wells rose rapidly in response to recharge from above normal precipitation. At the end of the month (February), although the level in many wells was lowering, the levels generally were much higher than normally at this time of year.


EXPLANATION
Stream flow among lowest 25 % of record during February
Stream flow among highest 25 % of record during February
Greater than any percentage previously recorded during February
Less than any percentage previously recorded during February
Month-end ground-water level in observation well
High
Normal
Low
Wells in formations heavily pumped shown by solid circles.
All numbers are percent of normal (median or mid value) stream flow for month of February

STREAM FLOW AND GROUND WATER IN RELATION TO NORMAL, FEBRUARY 1950

PROTECTION OF GROUND WATER SUPPLIES

EDITOR'S NOTE:

For a number of years we have been watching a development in the field of ground water that we feel should be of vital concern and interest to well drillers, engineers, and others engaged in the development, use and conservation of ground water.

We refer to a general awakening of the part of well users and public officials as to the importance and necessity of dependable sanitary ground water supplies. This has led to a number of regulatory and supervisory laws being passed having to do with licensing of well drillers, the adoption of well drilling codes, the construction of sanitary wells and the conservation of ground water.

In order that our readers may keep abreast of these developments, we intend to publish a number of these measures, some of which are now on the statutes and others that have been proposed. We feel that drillers should know about these things and be prepared to present their side of the case whenever such measures are up for consideration in their respective states.

All articles pertaining to these subjects will appear under the heading used for this article, so as to be sure our readers know what is going on.

WE WISH IT DEFINITELY UNDERSTOOD THAT IN REPORTING THE FACTS WE ARE NOT PASSING JUDGMENT ON THE MERITS OR NECESSITY OF ANY LEGISLATION NOW IN EFFECT OR THAT MAY BE PROPOSED LATER.

OHIO CONSERVES GROUND WATER

On May 16, 1941, Governor Bricker signed the bill which created the Ohio Water Supply Board. After taking up some pressing problems of the movement, the Board employed an engineer to outline a program and direct the activities of the department.

From 1930 to 1940 ground water was a perennial subject in Ohio. It was widely believed that the water table was falling about one foot per year. Actually, the rainfall in Ohio has been nearly normal since 1940 and the ground water levels have reacted accordingly, though heavy pumping in local areas still causes concern. The demand for ground water continues, increasing each year which has provided the Ohio Water Board with plenty of problems.

One of the first activities of the Board was a water table survey begun in October, 1942. It was a co-operative program between the Agricultural Extension Service and the Board. Observations are made on a quarterly basis during the water year, October 1 to October 1. In 1944, seventy counties were participating in the program with about 1,500 observers. At the conclusion of the survey, it was the Board's opinion that there was no

(Continued on Page 11)

(Continued from Page 10)

reason to believe that Ohio's water table was in danger of permanently declining.

In the meantime, the Board has expanded its facilities and activities to cover all phases of ground and surface water use and conservation. Many investigations have been made and reports issued.

In October, 1946, the Board published a tentative draft for water well construction in Ohio. A code on well construction was prepared by the Ohio Water Well Drilling Advisory Committee and endorsed by the Ohio Well Drillers Association. This code was prepared after much study and consultation between the two groups and then submitted to the legislature. However, it was not passed and therefore there is no legal support for the proposed code. The code at present is used in an educational way throughout the state and no doubt will be legalized at a later date.

In February, 1949, Bulletin No. 20 prepared by C. V. Youngquist, Chief Engineer of the Board, summarized the work of the Board and the water conditions in the state as follows: "Ohio is fortunately endowed with ample water resources. Their successful development, however, requires continuing inventory or appraisal and a correct interpretation of the facts obtained. This water inventory is a continuous job because unlike most resources, water is replenishable and fugitive. Hydrologic techniques have been developed, however, for accurately appraising the water resources."

This statement of Mr. Youngquest's covers the subject thoroughly. The trouble is that many states feeling secure with their present water supplies are making no effort to know what their water resources are, how they are obtained, or what becomes of them. The use of water of any kind is increasing each year but many do not appreciate the old warning, "when the well is dry, they know the worth of water."

The Ohio Water Supply Board is to be commended for the manner in which it has discharged its duties since being created. The vast amount of information it has collected, interpreted, and passed on to the people is of inestimable value. The people now know that the annual stream flow in Ohio averages 13 inches of the 38 inches of rainfall. The annual variation from the average is much more extreme than that of rainfall because stream flow is a residual—what is left after the prior demands of evaporation from the land and transpiration by plants. Evaporation and transpiration appear to be quite uniform in Ohio being related to average temperature. These demands are approximately 25 inches per year. It is thus apparent that a 10% reduction in average rainfall can readily cause a 30% reduction in stream flow.

Any one wishing to undertake a similar program should get in touch with the Ohio Water Resources Board at Columbus, Ohio. Charles E. MacQuigg, Dean of the College of Engineering, Ohio State University, is the present chairman.

A combination cable and rotary rig used by the Gray Well Drilling Company in the area around Delafield, Wisconsin. Rig had just completed an 8⅝-inch cased hole 245 feet to rock and then 55 feet into the rock.

—o—

(Ads Contd.)

FOR SALE: Failing 1500' and 1000' capacity drills, complete, drill rod, bits, tools, etc. Working in South Dakota. Write: Fred E. Butler, Box 1832, Casper, Wyoming.

WANTED: Experienced water well driller. Work in the Detroit area. References. Write: Box No. 196, Franklin, Michigan.

FOR SALE: Drilling Rig; one No. 21A Bucyrus-Erie with Cathead; 2 years old, mounted on 1936 Dodge Truck. Truck is in good condition. Machine complete with cables but less tools. $2,500.00. One No. 35 Armstrong Band Wheel Type, semi-mounted. No. truck furnished. Price $1,500.00, which includes a new rope 7 Tools for 5", 6" and 8" work. Rig has been well maintained. Ray D. Lacy, 4919 London Road, Duluth, Minn.

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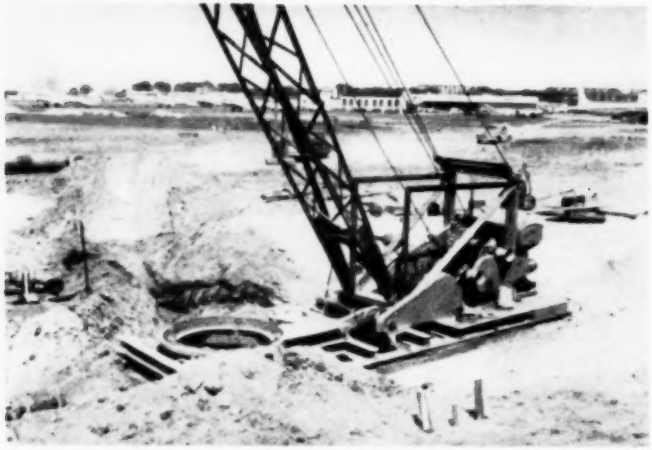


The Omaha Drilling Company and Jungmann Bros. of Topeka, Kansas, put down 48 pressure relief wells for the Corps of Engineers at the municipal airport in Kansas City, Missouri. The picture shows the hoist, boom and rotary table of the reverse rotary rig designed and used by the Omaha Drilling Company. The airport buildings and runways are in the background.

FOR SALE: No. 240 Speed Star used very little, mounted on 1937 International truck complete with all tools, bits, etc. Must sell to settle estate. $2,500.00. This machine was new in 1947. Write: Bill Hall, R.D. 2, Andover, Ohio.

FOR SALE: G.M.C. 1½-ton Int., 1½-ton Mack, 3 ton. Has 3 drum winch, all steel, for drilling wells or pulling pipe, ring slips, jacks, elevator 2' to 12' blocks, hooks, cables, chain tongs, light and heavy, air com. 2 cylinder blowers, forage, etc. One No. 28 Star, engines old, sand line sold, 2,500 ft. ⅞" w. cable, with tools from 2" to 12", bit, jars, D-clamps, heads, track and jack, rope clamps, crane, hoist, S. wrench, bailers, etc., $3,000.00 cash; 6" or 8" drill stems. Will carry one-half interest with the right fellow, must be able to weld electric and gas, sober, and under 50 years old, and know the drilling game. Also will rent a 150-foot by 50-foot steel and cement building for storage and shop. Address: Lock Box No. 64, Rock Glen, New York.

FOR SALE: One Ferguson well drill all-steel frame with wood mast 28', mounted on 4-wheel trailer with hard rubber tires; powered with 6 H.P. Fairbanks-Morse engine. Will sell very cheap. For more details, write: Shepard Bros., Well Contractors, 4047 Eighth Street, Des Moines, Iowa.

FOR SALE: One No. 5½ Keystone drilling machine, newly rebuilt, mounted on a 4-ton truck, with 6¼ and 8¼ bits, 4¾" by 23 ft. stem, jars, and rope sockets for manila and wire lines, sand bucket for 8" hole and dart valve bailer. No. 2 track and jack, 4" tool wrenches blower, ground tank and steel wagon or truck tank. Write: Sewell Well Company, 3970 Folsom Avenue, St. Louis 10, Mo.

WANTED: Experienced well driller for work in southern New England; good wages and steady work. In reply, please state age, experience, and references. Write: Gaines Drilling Company, Rockville, Conn.

(Continued on Page 15)

Wife (trying on hats)—"Do you like this one turned down?"

Hubby—"How much does it cost?"

Wife—"Twenty dollars."

Hubby—"Turn it down."

ASSOCIATION NEWS

This section is devoted to the exclusive use of water well drillers' associations, both state and local. Notices, announcements, changes of officers and other items should be sent to The Editor, Johnson National Drillers' Journal, 2304 Long Ave., St. Paul, Minnesota.

VIRGINIA MEETING

The recently formed Virginia Drillers Association will hold its first annual meeting at the Patrick Henry Hotel in Roanoke, Virginia, September 22 and 23. The committee in charge is at work on the program and also getting space lined up for the display of material and equipment. Mr. C. R. Sundquist, Secretary, P. O. Box 1568, Norfolk, Virginia, will be glad to furnish information regarding this

WISCONSIN MEETING

The 1950 convention of the Wisconsin Well Drillers, Inc., will be held at the Hotel Northland, Green Bay, Wisconsin, on May 19 and 20.

Various state and government officials interested in ground water and public health will appear on the program. In addition there will be a group of cowboy and cowgirl entertainers at the buffet supper dance and the annual banquet the following night. Tours are being arranged for the ladies after a special luncheon which will be provided for them. Secretary R. H. Nienow at Merrill, Wisconsin, is in charge of arrangements for the meeting.

NEW YORK MEETING

A regular quarterly meeting of the Empire State Water Well Drill-

(Continued on Page 13)

The warehouse and part of the drilling equipment operated by the Saltzgaber Drilling Company of Mansfield, Ohio. This firm, which is a father and son combination, has a good record over the years with many large capacity municipal and industrial wells to their credit.

The McCarthy Well Company testing a city well at Willmar, Minnesota. This well, which was gravel treated and about 300 feet deep, produced 1,600 g.p.m. with a drawdown of 27 feet, using a 12-inch Johnson Screen. Mr. Warren VanTassell, in the center, is Superintendent of Utilities at Willmar. Mr. Charles R. Podas, on the right, is an Associate of Pfeifer and Shultz, Consulting Engineers, Minneapolis, Minnesota.

(Continued from Page 12)

ers Association will be held at the Roger Smith Hotel, White Plains, New York, at 2 p.m. April 19.

Insurance and tax rates will be discussed at this meeting with suggestions as to how these costs may be reduced.

This association is planning for its meeting at Syracuse, New York, on July 13, 14 and 15. The meeting will be an exposition similar to the one held last year in Buffalo. It will be held in the Artillery-Engineer Armory in Syracuse. Full details of this meeting can be obtained from Ray S. Knapp, 5767 Genesee Street, Lancaster, New New York, Exposition Chairman.

KANSAS MEETINGS

The Southeast regional meeting of the Kansas Water Well Drillers Association was held at the Hotel Tioga, Chanute, Kansas, on February 25 with thirty drillers in attendance. Mr. E. J. Jungmann of Topeka was appointed chairman of a committee to study the laws of Kansas which affect water well drilling.

The dates for other regional meetings were set as follows: Southwest, a picnic at Garden City on April 30; Northeast, at Lawrence on July 8; the annual meeting at Great Bend on October 13 and 14. Mr. A. R. Leonard, Service Secretary, is located at Lindley Hall, University of Kansas, Lawrence. He will be glad to furnish information regarding these meetings.

INDIANA MEETING

The 19th annual convention of the Indiana Well Drilling Contractors will be held in the National Guard Armory at Fort Wayne on May 25, 26 and 27. The annual banquet will be held at the Hotel VanOrman.

Ample space will be provided for manufacturers and jobbers wishing to display or demonstrate their equipment.

Mr. H. K. Carr, Greentown, Indiana, can supply additional information as to the preparations being made for this meeting.

OHIO MEETING

A regular meeting of the Ohio Well Drillers Association was held in the State Office Building at Columbus, February 11.

Mr. K. C. Downer of the Permutit Company and Mr. George McLeod of Flint & Walling appeared on the program. It was reported that the advertising program recently instituted by the association was resulting in a large number of inquiries from the public.

NEVADA MEETING

A meeting of the Nevada well drillers was held recently in the Veterans' Hall at the State Building in Carson City. Twenty-two drillers were in attendance with a number of interested state and government officials.

Mr. Hugh Shamberger, Assistant State Engineer, organized the meeting and outlined the importance of the drilling industry to the state.

A committee consisting of William S. Wright of Dyer, Chairman;

(Continued on Page 14)

One might think it was not necessary to irrigate in New Jersey, but here it is, an irrigation well on a truck farm, put down by Charles P. Bainbridge of Hamilton Square. An 8-inch well with a capacity of 500 g.p.m. from a well 300 feet deep with 20 feet of screen.

Virgil Eaton operates this rig in the east-central part of Illinois. Here he is drilling a well for a locker plant just north of West Union.

(Continued from Page 13)

Mel Myer, Reno; E. C. Ferguson, Tonopah; S. R. McKinnon, Las Vegas, and Avery Blanchard, Wells, was appointed to form a constitution and by-laws and report at a meeting to be held in Tonopah November 11. There are about 75 licensed drillers in Nevada and it is hoped to have all of them in the new association.

MISSOURI MEETING

A feature of the 14th annual convention of the Missouri Association will be a demonstration of the Failing Holemaster 1,500 rotary drill at the Missouri Geological Survey Building at Rolla, Missouri. The hole will be logged at the Missouri Geological Survey with their electric logging truck and be donated to the Survey for use as an observation well in water level measurements.

A full program of speakers and entertainment will be provided for the meetings of the association, which will be held April 18 and 19. Mr. John Grohskopf, Assistant State Geologist, is Acting Service Secretary since Mr. Robert P. McNeal is now with the U. S. Geological Survey at Denver, Colorado.

IOWA MEETING

The 21st annual meeting of the Iowa Association was held February 15, 16, and 17 at the Warden Hotel in Fort Dodge. The registration was the largest for any meeting of this group in recent years.

A number of speakers addressed the group, among which were G. L. Kelso of the State Hygienic Laboratory on "Iron Bacteria," "Test Well Pumping" by R. M. Jeffords of the U. S. Geological Survey, and "Specialty Services to the Water Well Drillers" by Fred Holland of Brookfield, Illinois.

The Dutch lunch and prize drawing were held Wednesday evening followed by the banquet and dancing on Thursday evening. Special provision had been made for all ladies in attendance, including a dinner and entertainment for ladies only.

The meeting was voted the most enthusiastic ever held by the association. The new officers elected are: Sylvan Ames, Lincoln, President; C. L. Jennings, New London, Vice-President; Travis Parker, West Branch, Secretary, and Chalmer Bonnickson, Ringsted, Director.

NEBRASKA MEETING

The 19th annual meeting of the Nebraska Association was held at Nebraska Hall, University of Nebraska, Lincoln, February 23 and 24, with 182 drillers present. Forty-nine jobbing and manufacturing firms participated in providing entertainment, twenty-five of these firms having exhibits on the floor.

During the meeting, John Sulek, Department of Agricultural Engineering of the University, spoke on the "Performance of Vertical Turbine Pumps," Mr. William Kelly of Grand Island, Nebraska, and Mr. E. W. Bennison of Edward E. Johnson, Inc., St. Paul, Minnesota, on "Gravel Treated Wells." Mr. Charles S. Osborn, U. S. Bureau of Reclamation, McCook, Nebraska, addressed the group on "Effective Means of Drilling Hard Materials." Mr. V. C. Mickel of the Failing Company, Enid, Oklahoma, showed colored moving pictures of an irrigation well being constructed. Mr. Mickel described each operation from the start to the finish of the well.

At the noonday lunch in the Student Main Building there were 136 drillers in attendance. The night of the Dutch lunch and annual meeting of the "Spanish Athletes" 260 enjoyed the food and entertainment provided by the jobbers and manufacturers. Andrew Olson of Oakland won the prize for the oldest driller in attendance. Dr. George E. Condra gave one of his characteristic dynamic addresses on "The Well Driller's Responsibility in a Changing Nebraska." The Honorable Robert W. DeVoe, President of the Board of Regents of the University of Nebraska, addressed the group briefly as did Mr. James S. Pittenger representing Governor Val Peterson.

The new officers elected for 1950 are: Howard O. Parkert, Hooper, President; Fred D. Salmon, Concord, Vice-President; Andrew Olson, Oakland, Treasurer; and Vincent H. Dreeszen, University of Nebraska, Secretary. Plans are under way for a larger meeting room and more exhibit space at future meetings.

WASHINGTON MEETING

The 3rd annual meeting of this association was held at Yakima, Washington, November 11 and 12, 1949, with a good turnout of members. Several speakers addressed the group on subjects of interest

(Continued on Page 15)

Woodcum & Sons have drilled wells in the vicinity of Pontiac, Michigan, for many years. The picture is one of their rigs putting down a 6-inch well at a "drive-in" restaurant along the highway.

(Continued from Page 14)

to the drillers. Metal plates signifying membership in the association were on display at this meeting. It was decided to hold the next annual meeting in Seattle on November 11 and 12, 1950. Regional meetings will be held during the year at Olympia on March 18 and Wenatchee on July 15. Mr. O. E. Erdman, Elma, is Secretary-Treasurer of the Association.

MICHIGAN MEETING

This association will hold its 22nd annual meeting at the 119th Infantry Armory Building in Lansing June 20 and 21. Plans are being made for a larger convention this year with more exhibits and entertainment than ever before. All details will be presented in the annual yearbook now being prepared. Mr. Harold Armstrong, Chairman of the Convention, will be on hand at the Armory on June 19 as it is desired to have all exhibits in place when the convention opens.

The annual banquet and entertainment will be held on Wednesday evening, June 21, at the Masonic Temple in downtown Lansing.

For full details, write Leo Riegler, President, at Muskegon, or Harold Armstrong, Secretary-Treasurer, at 484 Capital Avenue S.W., Battle Creek.

GAL 5

COLORADO MEETING

The 16th annual meeting of this association was held November 4 and 5 at the Shirley-Savoy Hotel in Denver. A total of 172 people registered in for the meeting. An outstanding educational program was provided by the committee under Archie Hier, chairman.

All officers were re-elected for the coming year, except E. Josephson, Director, who was replaced by Burton Payne. Mr. Lloyd G. Oliver, President of the Association, is very much interested in legislation affecting the interests of well drillers throughout Colorado.

MINNESOTA MEETING

The Minnesota Association held its 28th annual meeting at the Nicollet Hotel in Minneapolis, March 15, 16 and 17, with the largest attendance of recent years.

The meeting was called to order by President Ed Renner, who was followed by Governor Luther W. Youngdahl, with an address of welcome. The program was carried out completely. Among those appearing was Mr. Chester S. Wilson, Commissioner of Conservation, State of Minnesota, and Mr. Tom Finley, State Safety Supervisor.

The noonday Dutch lunch provided by R. R. Howell Company was enjoyed by all. The following evening the annual banquet held in the Ball Room brought together about 375 people who were served a real roast beef dinner. F. A. Galbraith as Master of Ceremonies led the group singing and introduced the out-of-town guests and entertainers. This was a very enjoyable affair which was made possible by the jobbers' and manufacturers' co-operation.

The officers elected for the coming year are: John Hoge, St. Paul, President; Martin P. Christiansen, Pengilly, Vice-President; Al Zuercher, St. Paul, Secretary-Treasurer; Norm Ovram, St. Paul, Executive Secretary. The new directors are: Martin Mastrian, Wentworth, Wisconsin; Mike Ice, Wayzata; Algot Johnson, Parkville; Harold Lindman, Minneapolis; and A. E. Mueller, Gaylord.

MONTANA MEETING

The Montana Water Well Drillers Association held its 5th annual meeting at the Civic Center in Lewistown, Montana, April 3 and 4. The meeting was well attended by drillers and representatives of supply houses.

Among those appearing on the program were: Frank A. Swenson, Geologist in Charge, Ground Water Branch of the U. S. Geological Survey at Billings; Dean W. M. Cobleigh of Montana State College, Bozeman; and Calvin D. Hembree of Casper, Wyoming. Mr. Hembree is Assistant Superintendent of the Rocky Mountain Division of Halliburton Oil Well Cementing Company.

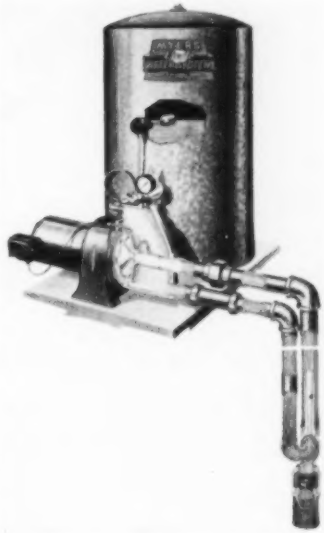
The annual banquet held April 3 at the Burke Hotel was in charge of W. W. (Bill) Gail of Billings, who acted as toastmaster. This was an outstanding feature of the meeting which ended the next day after the annual business meeting and election of officers.

(Ads Contd.)

WANTED: Steady job as driller; married with one child. Write: Lloyd Bjorklund, Holmes City, Minnesota.

WANTED TO BUY: All-steel drilling rig for 5-inch work with or without tools. Write: Joe Erhard, Box 275, Renville, Minnesota.

NEW LINE PUMPS AND WATER SYSTEMS



The F. E. Myers & Bro. Company of Ashland, Ohio, now offer a completely new line of water systems and pumps after many years of experience in designing and building jet pumps.

The new H N line is easily convertible from shallow well to deep well use. It is highly efficient, simple in construction, easy to install and maintain. To change from shallow well use to deep well use, it is necessary to change only one threaded connection and add the necessary well pipe and deep well ejector. No bolts, gaskets, special parts or tools are required to make this change.

The H N line is motor driven with standard motors, or it may be belt driven, direct connected to gasoline engine drive. To permit a minimum of stock to meet all well conditions, the pump unit and ejector assemblies are packaged separately. With this system one basic pump unit and several ejector packages make it possible to meet any well condition within the range of the pump.

At present the new line is available in four motor horsepower, ½, ½, ¾, and 1 and for all well lifts up to 120 feet.

What Does It Take?

In the horse and buggy days there was an old saying, "You Can't Do Business From An Empty Wagon."

It is **still** true today.

After designing the most efficient screen on the market, that's why we use nothing but the best materials and the best workmanship available — which means that our Wagon Is Always Full of quality products to solve any sort of screening problem.

Complete information on Johnson Well Screens is available for the asking.

When Better Screens Are Made Johnson Will Make Them

Edward E. Johnson, Inc. Manufacturers Exclusively **St. Paul 4, Minn.**